Identifying Transit Needs in Carver County

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CARVER COUNTY

METROPOLITAN COUNCIL

Resilient Communities Project
UNIVERSITY OF MINNESOTA
Building community-university partnerships for sustainability

The project on which this report is based was completed in collaboration with the Metropolitan Council and Carver County as part of the 2020–2021 Resilient Communities Project (RCP) partnership. RCP is a program at the University of Minnesota's Center for Urban and Regional Affairs (CURA) that connects University faculty and students with Minnesota communities to address strategic projects that advance local resilience and sustainability.

The contents of this report represent the views of the authors, and do not necessarily reflect those of RCP, CURA, the Regents of the University of Minnesota, the Metropolitan Council, or Carver County.

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University of Minnesota–Metropolitan Council–Carver County

Final Report

#RCP-10b

Group 3

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April 27, 2021

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EXECUTIVE SUMMARY

Carver County is a suburban county located southwest of Minneapolis, MN. It contains the suburban communities of Chaska, Chanhassen, and Carver, as well as various rural townships. Due to Carver County's proximity to Minneapolis and St. Paul, many residents use public transportation to commute to the cities for work, shopping, medical visits, and tourism. The Carver County Resilient Communities team is seeking recommendations for potential public transportation insufficiencies or "gaps." The county has seen large growth over the past 10 years and is anticipating further growth in the next 5–10 years as well. Therefore, Carver County needs to reassess its ability to provide effective public transportation to its growing population.

Currently, Carver County offers multiple types of transportation services to its population. The most frequently used transportation services are SouthWest Transit and Transit Link. SouthWest Transit is a public bus service that runs from the southwest metro area to downtown Minneapolis, with three stops within Carver County itself. Transit Link is a public van service offered through MetroTransit.

The unique blend of rural and suburban land in the county requires carefully planned transit initiatives to meet the needs of all residents. Various demographic factors, including but not limited to, age, car ownership, employment, and income, must also be considered since Carver County wants to ensure equal and easy access to transportation for all of its residents.

The descriptive analysis on the provided ridership and population data yielded cities of interest with high percentages of transit use, high percentages of a certain demographic of the population, or high population growth coupled with an inconsistent employment rate. Based on some of these inconsistencies, the project team explored further the relationship between these points of interest and the transit providers available in the area.

Based on the cities of interest and ridership, schedule, and type of service for each transit provider, the project team was able to make data-based recommendations on expansion opportunities for SouthWest Transit, Transit Link, and other transit-related initiatives to better

serve the residents of Carver County in the future. These project recommendations will provide a starting point for Carver County to explore in the next 20 years on the way to achieving the goals outlined in the 2040 Comprehensive Plan.

Carver County has already commenced plans for a transit behavior survey to be published, the results of which will be used in tandem with the data-backed results of this project to identify areas of interest, potential gaps, and current disparities to be addressed in planning for Carver County's future residents and future transit initiatives.

PROJECT DESCRIPTION

Background

As identified by Carver County residents, transit has become a top priority, especially as the county's population is projected to grow by 50% over the next 20 years. Other factors specific to Carver County that require attention are the aging population of Carver County and the unique combination of land use. Carver County encompasses both urban and rural areas. Based on these factors, Carver County is expecting significant changes in traffic patterns as well as an increase in transit dependent residents over the next 20 years. COVID-19 has also brought unanticipated consequences for the Carver County transit system. An increased proportion of residents working from home and higher unemployment rates has further complicated the planning process for future transit needs.

Carver County has developed a 2040 Comprehensive Plan with the goals of "creating a strong transit system, which can be an integral part of growth and development in the county" and "establishing multi-modal transportation options for Carver County residents and workers to support a high quality workforce and the needs of an aging population."

In this project, the team conducted the analysis of the ridership data and made recommendations based on the findings in the analysis. The findings will help Carver County improve their transit system and provide a better service to their residents. In order to

understand where the County's transit system is currently at, determine county-wide transit needs, and take initial steps toward the implementation of the 2040 Comprehensive plan, the project team conducted data analysis as part of the County's transit study. The ultimate goal of the project was to identify gaps and overlaps within the transit system and provide the results to Carver County with recommendations about transit system solutions based on the county's current and future needs.

At the beginning of the project, background information was needed to inform the team's data analysis and work on this project. The provided information about the County's current system, transit providers, routes, and population demographics was utilized in addition to the ridership data to inform the recommendations at the end of the project. The provided information helped the team understand any limitations or risks associated with the use of each provider when compiling the final recommendation plan.

The initial areas that the team focused on were:

- Ridership trends
    - Seasonality
    - Origins and destinations
    - Reasons for use
- Transit accessibility
- Appropriate methods of transportation for Carver County residents
    - Fixed route vs. demand response

Examples of the guiding questions the team looked to answer throughout the course of this project included:

- How will the populations of Carver County communities change by 2040?
- Are there gaps in the routes, service type, service area, or schedule offered by the transit companies?
- What do employment rates in individual communities look like?

The team also completed a literature review to understand existing transit system trends, especially in areas geographically and demographically similar to Carver County. The findings from the literature review were used as a basis for data analysis and recommendations. Understanding the successes and challenges of similar communities when implementing transit systems aided in directing the project team's focus when looking at transit provider types, routing issues, and population changes.

Sponsor and Stakeholders

This project was sponsored by Carver County in conjunction with the Resilient Communities Project (RCP) through the University of Minnesota. As the Metropolitan Council is responsible for much of the transit programming in the Twin Cities and surrounding areas, the Metropolitan Council was also a stakeholder for this project as they will work with Carver County in regard to transit decisions. Primary contacts for each sponsoring organization are as follows:

- Project Lead, Carver County: Adriana Atcheson, Planner, aatcheson@co.carver.mn.us
- RCP Contact: Sarah Tschida, RCP Coordinator, University of Minnesota, tschi066@umn.edu, 612.625.6550

A **RACI** matrix, found in Appendix A, lists the people involved with the project, and who is **R**esponsible, **A**ccountable, **C**onsulted, or **I**nformed on project and product deliverables.

Product Deliverables

The following table outlines the product deliverables that were given to Carver County when the project was completed.

Product Deliverable	Description	Due Date
Gap Analysis Report	Findings that document the gaps in coverage by the current Carver County transit system as well as any public transit	4/23/21

	services that overlap. Areas of the system that were analyzed are routes, schedules, geographic service areas, transit methods, and demographics being served. The report advises Carver County on ways to improve their transit system to better serve their residents.	
Methodologies Report	A document that outlines the data analysis methods we used to draw the conclusions and produce our Gap Analysis Report	4/23/21

Table 1: Product Deliverables

Key Metrics

The team compiled a comprehensive list of data-analysis findings and data-driven recommendations for Carver County's transit system. To determine the effectiveness of this project, the team considered the recommendations of key factors a success if they are accurate and deemed satisfactory for Carver County. The key factors that the team assessed and made recommendations for include:

- determining underserved areas of Carver County, geographically and demographically
- recommended type of transportation vehicles needed (i.e. buses, vans, taxis, etc), type of service (i.e. fixed route, demand response, etc.) and suggested provider (private or public)
- allocation of public and private funding

Limits and Exclusions

In outlining the scope of the project the team identified nine limits and exclusions. These limits were used to help guide the work that was conducted by the project team.

1. The team was not responsible for transit recommendations outside of the jurisdiction of Carver County.
2. The team did not provide the transit providers with recommendations.

3. The team was not responsible for the direct implementation of transit recommendations or legal ramifications regarding policy implementation.
4. The team was not responsible for the allocation of funds directed to transit policies in Carver County.
5. The team will not be providing Carver County with any future reports after the delivery of this one.
6. The team did not advise Carver County on anything besides their transit gaps, overlaps, and the potential transit needs as the population grows.
7. The team was not responsible for the purchase or acquisition of new equipment, software, or vehicles needed to meet transit recommendations.
8. The team did not use any of their own funds to purchase any required software or tools needed for the analysis of the data.
9. The team was not responsible for gathering their own data beyond what is already available from Carver County, the transit companies, census data or other online/UMN databases.

TECHNICAL APPROACH

A data-driven approach to descriptively analyze the current Carver County Transit system was used to understand the relationships between Carver County's transit ridership numbers and the demographics of the Carver County population. Geographic information was also used to understand the origins and destinations of rides in the county as well as planned land use for certain communities of interest.

Specifically, the focus of this project was to understand the utilization of the different transit providers, how the accessibility of transit differed by area, and the role the demographics of Carver County residents play in their access to and use of transit options in the county.

The data for this project was provided by a sponsor at Carver County and found through public databases like the United States Census Bureau with a tool called Social Explorer. Ridership data

and population data served as the primary categories of data and were analyzed separately and together for correlation and trend analysis.

Literature Review

A literature review was also conducted to look for studies in similar areas to serve as a point of reference. The top findings from the review are summarized below.

Source	Finding	What this means for our project
Blumenberg, 2002	Transit is listed as #1 barrier to employment for those receiving government aid or on welfare	Extra focus on areas with high unemployment
Sanchez, et al., 2003	Automobile ownership positively correlates to employment potential	Understand automobile ownership rates and densities (areas) in CC through survey.
RCP Group Report, 2020	Fixed-route services for transit-dependent residents within the county are limited ● Jefferson Lines is only provider with fixed routes completely within the county	● Explore feasibility of expansion of fixed route options within the county.
Urban Mass Transit Administration, 1979	Public transport access is typically considered adequate if persons live within a 0.25-mile walking distance of a stop or station (UMTA, 1979). Beyond 0.25 miles, the time cost and inconvenience usually inhibit the use of public transport.	EXTRA MILE: Understand relationships between popular stops, pickup/dropoff locations and a 0.25 mile radius to see where population density lies and where higher density of typically transit dependent citizens live (age, income, etc.) ● Compare current to population projections to see where high density areas may not have transit hubs

Older people and transport: coping without a car, 2007	• Lifts in other people's cars were by far the most common substitute for private transport for elderly people without a license. • Taxis are expensive but often used in lieu of other modes if time or convenience is a factor and getting a ride is not possible. • There are rides available for 'serious' travel but 'discretionary' travel is not as available. A lack of discretionary travel can be a cause of decreased satisfaction in life.	Providing rides for 'discretionary' travel would increase the quality of life for transit-reliant residents. We can look for ways to provide more access to public transit in the evenings or weekends.

Table 2: Summary of top findings from literature review to inform this project.

Ridership Data

To evaluate the current state of the transportation system in Carver County, the team analyzed ridership data. The data that was used in the project was provided by SouthWest Transit, Transit Link, and Metro Mobility.

Transit Provider	Description
SouthWest Transit	A large transportation provider in the Twin Cities that offers both fixed route transportation as well as rideshare services. The data we have from them is monthly ridership on each route for the last 5 years.
Transit Link	A rideshare service that works throughout Carver County. The data we have from them is monthly ridership from each city to every other city for the last 5 years.
Metro Mobility	A rideshare service that can be used by certified riders. Metro Mobility is designed to service people who cannot utilize other public transportation due to disabilities and or health conditions.

Table 3: *Transit Providers*

To gain insights from the data the team looked for trends in ridership. Trends included

- increased ridership as population has increased
- variations in ridership due to seasonality, and destinations/routes that are most frequented.

To look for trends relating to population, the team compared the population data to ridership data from the past five years. To identify seasonality trends the team analyzed monthly ridership data looking for what months see the highest and lowest ridership. To identify the destinations and routes that are most frequented, the team created heat maps of locations that had the highest frequency of pickups and drop offs. (Figure 4 and Figure 5). In order to effectively conduct the analysis, all data was formatted uniformly in an Excel spreadsheet.

Population and Demographic Data

The population and demographic data available to the team was in the form of public data, population projections through 2040, traffic zone analysis, and planned land use. The population projections were broken down by city or township into 10 year increments. These 10-year increments align with the Metropolitan Council's Travel Behavior Inventory Survey which is conducted and has results published every 10 years.

Some of the specific datasets that the project team examined:

- Income levels
- Population growth
- Population density
- Age
- Infrastructure - locations of healthcare buildings, grocery stores, pharmacies, etc..

The team used the county-provided population projections to create heat maps and verified the population projection heat maps with the route utilization and rider origin data to gain a basic understanding of the high volume areas for transit use and population concentration. Trends in the rider data were cross referenced with the population data as well as the

demographic data, as Carver County has a vested interest in understanding the demographics of their transit users.

A County-sponsored survey, as a continuation of this project to gather more information from the resident's of Carver County about their transit-based behavior, is currently being drafted. Results from that survey will be used in combination with the data-based ridership and population results and recommendations of this project in order to make holistic decisions about the county's future transit system.

Age, employment status, and other demographic pieces of information were essential to the team's understanding of the county's residents. After initially analyzing the ridership and population data separately, they were cross referenced to answer other questions the team had regarding the residents of Carver County and their transit needs:

- How will the populations of Carver County communities change by 2040?
- Do the routes, service type, service area, or schedule offered by different companies overlap?
- Are there gaps in the routes, service type, service area, or schedule offered by the transit companies?
- What do employment rates in individual communities look like?
- What infrastructure is geographically proximal to rural communities or is lacking in rural communities?

These questions were deemed relevant to the project based on the datasets available to the team and the areas of interest provided by Carver County to the team in initial scope discussions.

Software

The technology and software that was used for this project was Microsoft Excel and GIS software. Excel was utilized throughout the project to compile and analyze the ridership data that was provided. The GIS software was used to create visuals of population demographics as

well as ridership of the varying transit providers. Using the GIS software, all heat maps were created on the same map. This enabled the project team to quickly compare the different data sets when looking for trends.

Data Analysis

Based on the project scope from the sponsors at Carver County and the type of data available, much of the data analysis performed was descriptive analysis. Carver County is interested in the information revealed by ridership and population trends within the county, and has plans for a continuation of this project in the form of a transit behavior survey for county residents. The results of this project and the results of the survey will both be used to inform Carver County's future transit system decisions.

Transit Link

One of the main data sets that the project team received for this project was the ridership data from the transportation provider Transit Link. Transit Link is a ride sharing service that offers transportation to the general public across the Twin Cities metro area. An example of the data that was received is shown in Figure 1 below.

	A	B	C	D	E	F
1	Long Date Year	Long Date YYYY-MM	Pickup Location City	Dropoff Location City	Total Passenger Trip	
2	2016	2016-03	BELLE PLAINE	BELLE PLAINE	46	
3	2016	2016-03	BELLE PLAINE TWP	SHAKOPEE	46	
4	2016	2016-03	BURNSVILLE	PRIOR LAKE	23	

Figure 1: *Transit Link Raw Data*

As seen above, the data records the number of trips that occur between two cities within a given month. It is important to note that the dataset lists the cities, not specific street addresses. Due to this lack of detail the team is not able to pinpoint where the exact pick up and drop off locations are. Along with this, the data set originally included ridership data for cities that were not inside Carver County. To ensure that the data was an accurate representation, all data points that did not include a pick up or drop off location of Carver County were removed. This means that the data set now represents rides that originated in Carver County, had the destination of Carver County, or both.

To gain an understanding of where the riders were picked up and dropped off, two maps were created. The first map documented all of the locations in and around Carver County where riders were picked up.

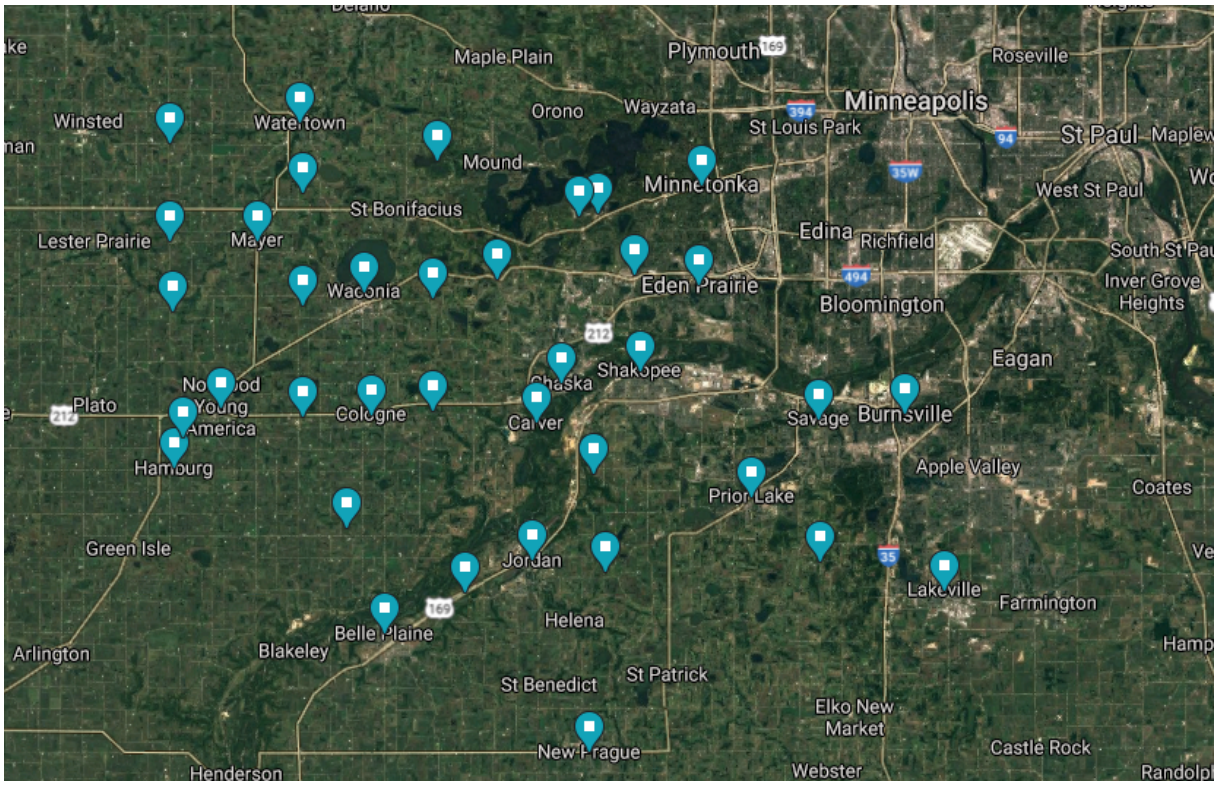

Figure 2: *Transit Link Pick Up Locations*

The second map that was created documented all of the locations in and around Carver County where riders were dropped off. These maps allowed the team members to understand where the riders were coming from and going to in and around Carver County.

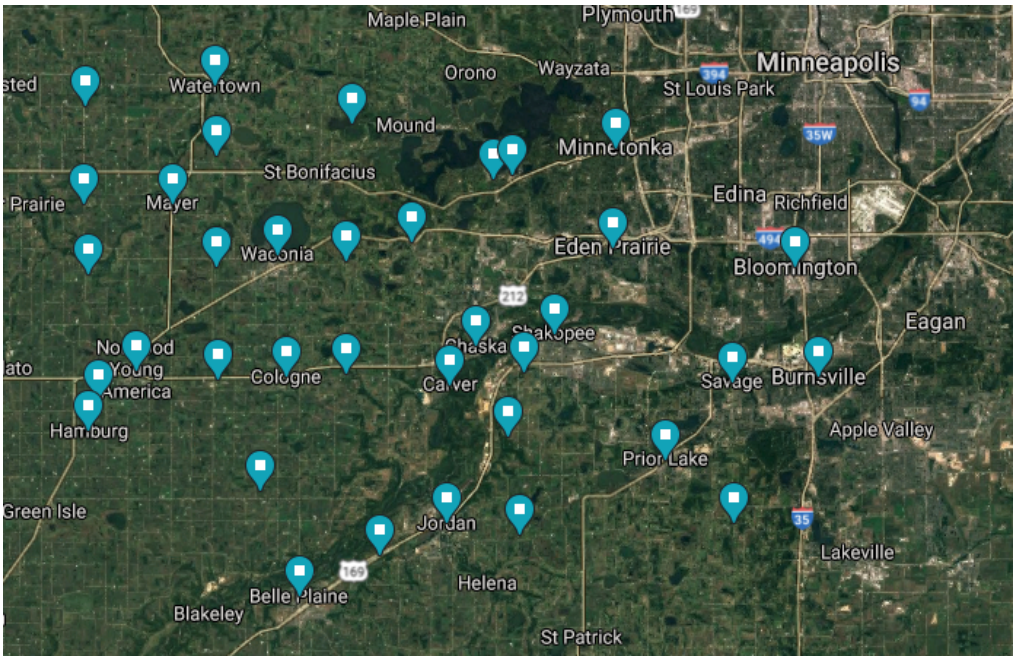

Figure 3: Transit Link Drop off Locations

After the project team identified these locations, the data was aggregated to calculate total number of pickups and drop offs for each location. This data was then used to create two heat maps that displayed the frequency of pickups and dropoffs in and around Carver County.

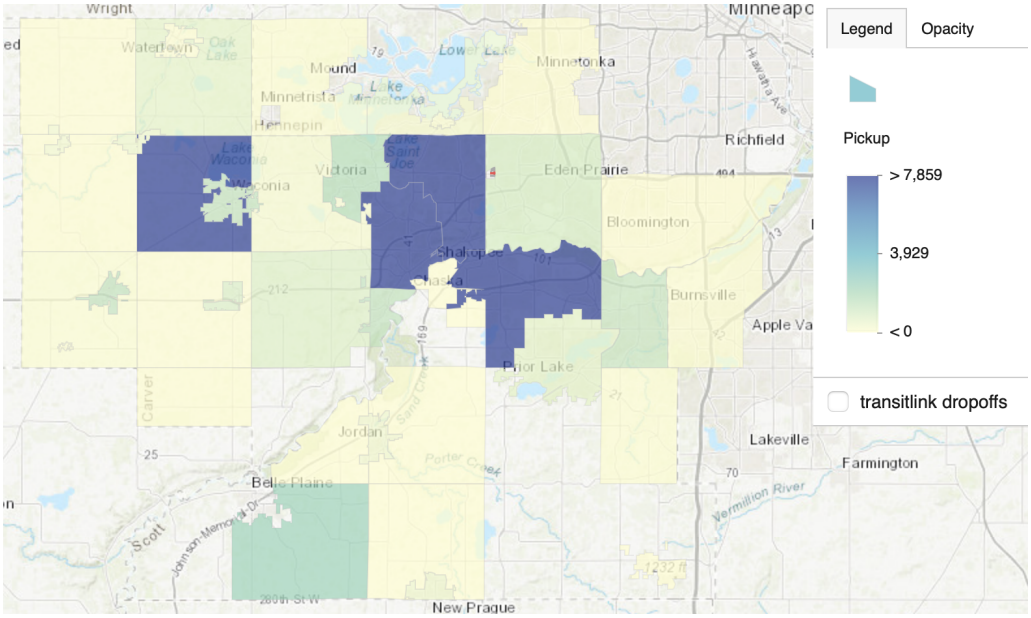

Figure 4: *Transit Link Pickup Heat Map*

The heat map above depicts the frequency of pickups. It can be seen that the majority of pickups were around the population centers in Carver as well as Scott County. In Carver County most pickups occur around Waconia as well as Chaska. In neighboring Scott County the majority of pickups occur around Shakopee. This high frequency of pickups is depicted by the blue hue in the heat map. In analyzing the heat map the team made note of the city of Victoria. Victoria was identified because of its higher frequency of pickups and its location next to Chaska. A total of 41% of all Transit Link pickups occurred in Chaska and with the projected 2040 population, the team concluded that Chaska and neighboring Victoria will see an increase in population that will require public transit adjustments.

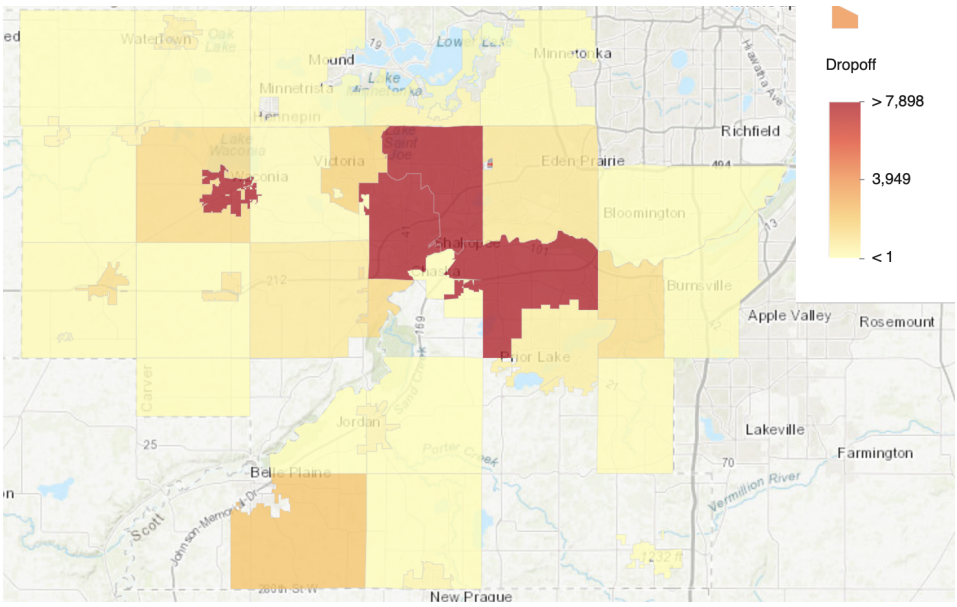

Figure 5: *Transit Link Drop Off Heat Map*

The second heat map that was created from the Transit Link data was used to display the dropoff locations around Carver County. Like with the heat map used to display pickups, most of the dropoffs occurred in Waconia, Chaska or Shakopee. Chaska saw the largest percentage of dropoffs, with 40.6% of all dropoffs, followed by Waconia with 15%. The red hue displays this trend on the above figure. It was identified that most dropoffs occurred in larger cities. The team concluded that this occurred because the larger cities have destinations such as hospitals

and stores that are desired by the residents. These options are not as easily available in the rural areas.

SouthWest Transit

The next data set that the team relied upon was the ridership data for the fixed route provider SouthWest Transit. The data provided for SouthWest Transit was monthly ridership for the past 5 years. In order to gain a better understanding of this data set the team summed all of the monthly ridership and then found the yearly averages. In doing so the team identified the two most popular routes that serviced Carver County. The most popular routes were

- Route 690 with 340,000 annual riders
- Route 698 with 170,000 annual riders

Route 690 offers service from Carver Station to downtown Minneapolis. The map below displays the route that is utilized.

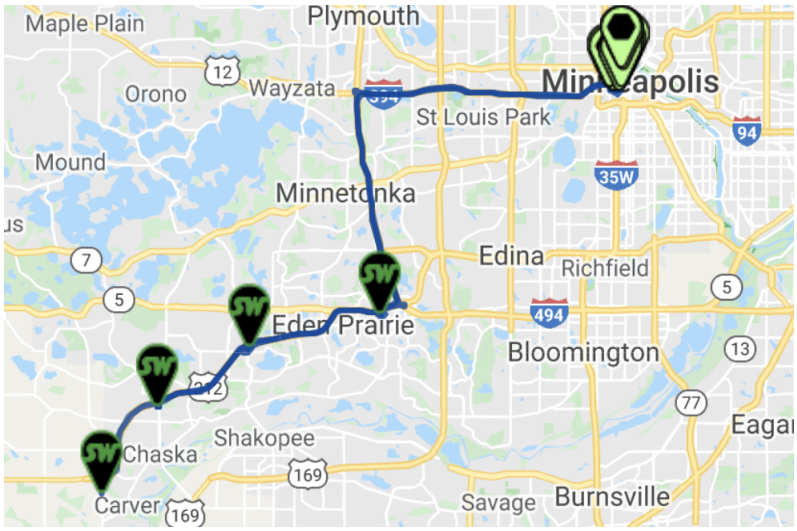

Figure 6: *Route 690*

Route 698 takes the same route that is depicted in figure x but it does not go to Carver Station, instead it services the East Creek Station in Chaska to downtown Minneapolis. To look for seasonality and ridership trends the team analyzed the provided data. The team did not identify any trends with seasonality or ridership when looking at the routes 690 and 698.

One trend that the team found was with route 682. Route 682 is a service that brings residents of Carver County to the Minnesota State Fair. This route is only in operation for the duration of the fair, yet in the past 5 years, it has had 509,857 riders. The ridership has increased at an average rate of 7% per year in the last 5 years. The graph below depicts the positive trend in ridership that this route has experienced.

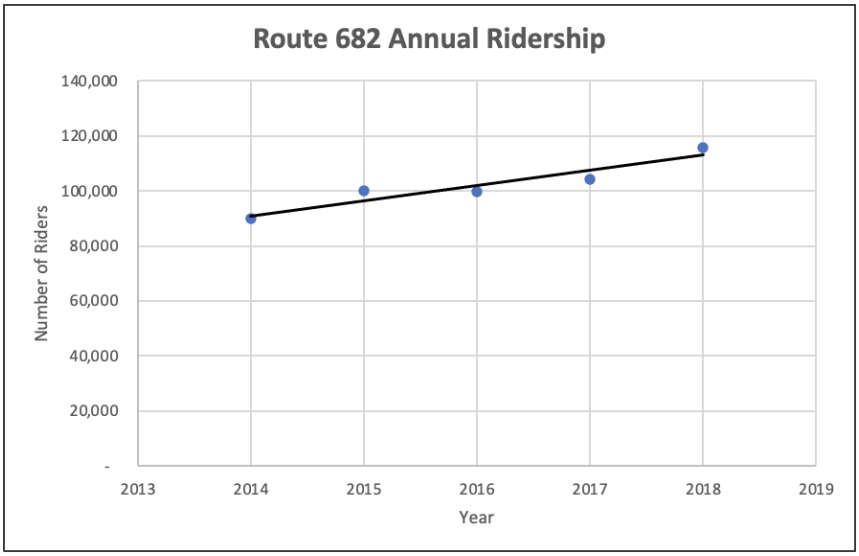

Figure 7: Route 682 Annual Ridership

Even though only operational for part of the year, the team felt it necessary to note the increasing ridership on route 682. Carver County may need to make adjustments in the future to properly service this increasing trend in ridership, especially as the county population increases.

Metro Mobility

Metro Mobility is another transit provider for which ridership data was supplied. From a heat map of Metro Mobility pickups and dropoffs within Carver County, the project team immediately noticed that Metro Mobility does not serve the western half of the county. From a geographic and demographic standpoint, this is a widespread area with a rising population of residents who may qualify for Metro Mobility services.

Metro Mobility is different from the other transit providers because they focus on offering transportation for those with disabilities, health conditions, or anything that might preclude

these residents from taking other transit. Not offering this service to rural areas means residents in these areas have to rely on other transportation, public or not, that might not be adequately prepared to assist Metro Mobility–eligible residents with their needs.

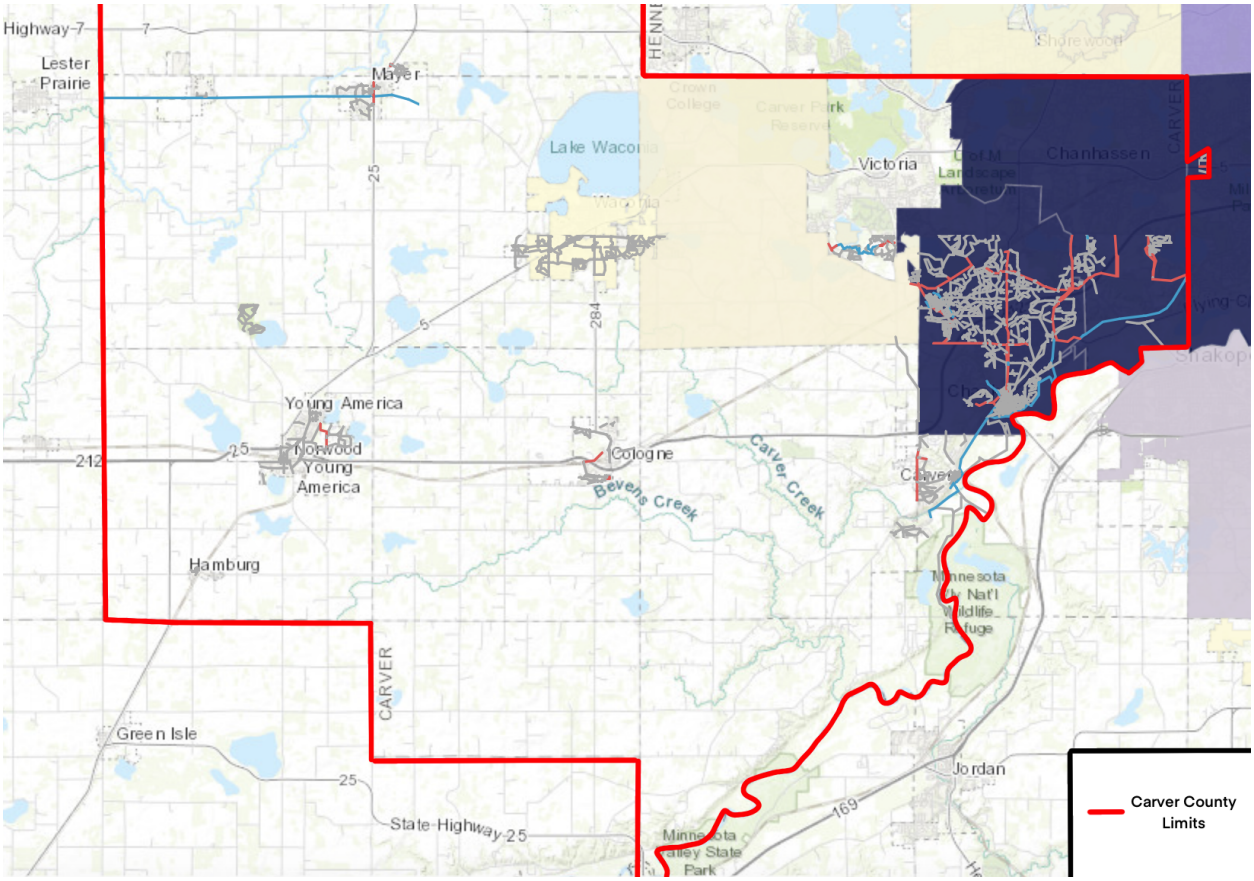

Figure 8: Heat map showing Metro Mobility Pickups in the Carver County area.

An inference made by the team based on the Metro Mobility service area being limited to just the eastern portions of Carver County is that residents of those smaller, rural communities who qualify for Metro Mobility may be turning to other transit providers to obtain transportation. This could potentially result in higher demand for other services in the area like Transit Link, which does deny requested rides if there is inadequate supply of drivers and vehicles. The drafted behavioral survey of Carver County residents on their transit usage may yield more insight in the future for Carver County. The project team has identified that the limiting factor of Metro Mobility's service area combined with the increasing county population may be a point of interest as a gap in the county's transit system.

Population and Demographic Analysis

The other main source of data is related to Carver County population projections and demographics. The project team was interested in certain demographic indicators to assess whether there may be higher transit dependency in areas of Carver County. In some cases, the demographic indicators may have acted as limiting factors in accessibility to, or ability to use, transit.

A heat map of Carver County with percentages of households by total annual income did not reveal any disparities between communities with low income and a lack of transit options. Transit Link is available to all Carver County communities, meaning that all residents have access to at least one flexible, demand-response transit service.

In line with the County's 2040 Comprehensive Plan, projections for populations, households, and employment were calculated for each city and township in Carver County. The County expects to attract 64,000 new residents, which would add 27,600 new households and 18,000 new jobs (see Appendix B for full table of projections).

City or Township	Population				Households				Employment			
	2010	2020	2030	2040	2010	2020	2030	2040	2010	2020	2030	2040
Carver	3,724	6,300	10,300	15,500	1,182	2,120	3,630	5,600	187	650	1,030	1,700
Victoria	7,345	10,000	12,600	15,400	2,435	3,500	4,570	5,700	1,502	2,100	2,380	2,600
Waconia	10,697	14,200	20,600	24,000	3,909	5,400	8,000	9,500	5,578	7,600	8,700	10,200
Waconia Township	1,228	1,320	1,430	1,480	434	490	560	600	98	240	330	380

Figure 9: Condensed version of table in Appendix X showing cities of interest.

From the projections table (Figure 9), and the change in population heat map (Figure 10), the project team identified the community of Victoria and the combined Waconia and Waconia Township area to be points of interest. Other areas with high rates of population change on the heat map such as Chanhassen, Chaska, and Carver are already served by multiple forms and providers of transit services.

From Figure 9, it was calculated that the population of Victoria is projected to be similar to that of Carver by the year 2040. In 2040, it is also projected that only 16.9% of the population of Victoria will be employed within that community. Similarly, the city of Carver is expected to employ 11% of its working population within the city of Carver. This indicates that many of the residents will live in the community but will commute elsewhere for work.

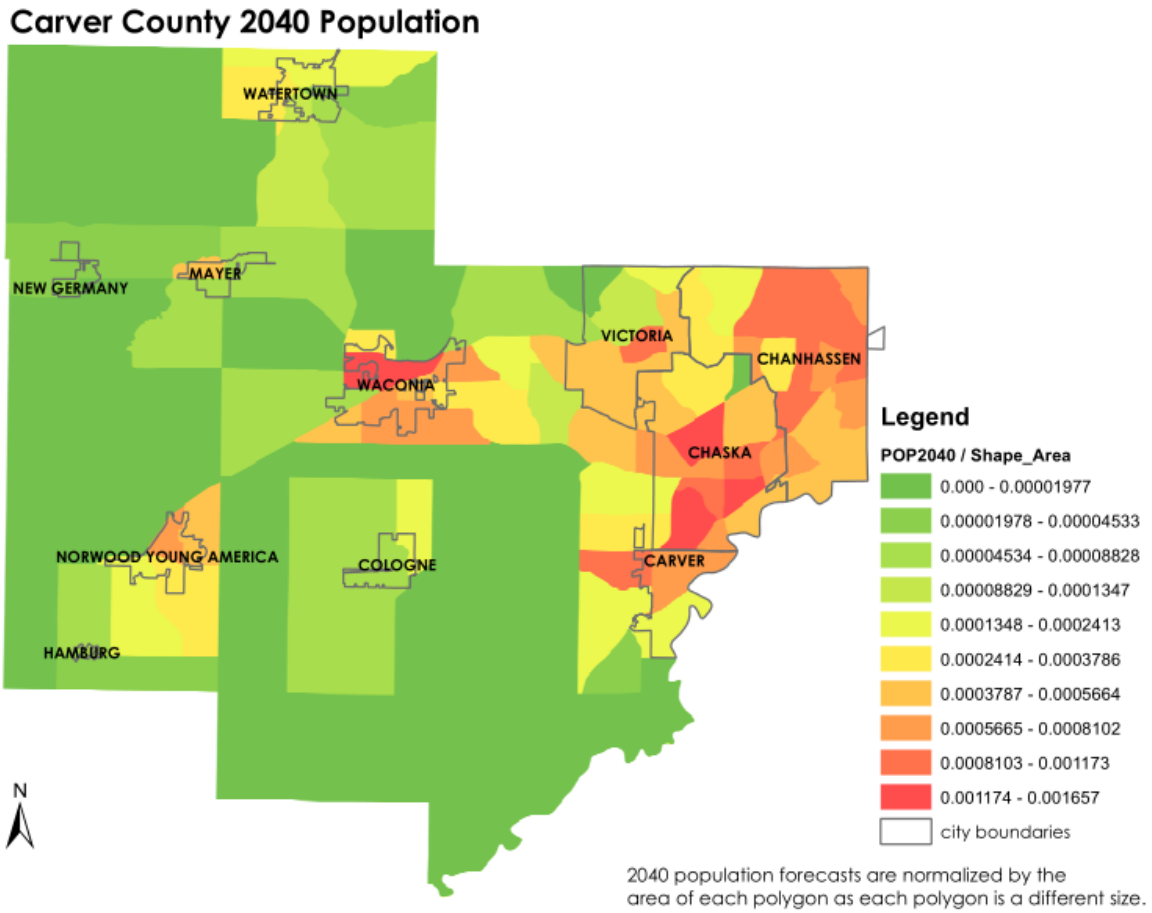

Figure 10: Projected percent change in population by area.

A few factors lead the project team to believe that Victoria has the potential to become a suburban commuter city. The low employment rates in both Victoria and the city of Carver, as well as the comparable population sizes of the two cities, were indicators that Victoria could potentially be trending toward becoming a commuter city. Knowing that Carver has a dedicated SouthWest Transit stop for commuters, the team has identified the possibility of the community of Victoria needing similar increased transit support and options for future commuters.

The team confirmed the theory that Victoria could become a developed commuter community based on the planned land use data provided by Carver County, which shows that the undeveloped area around Victoria is zoned for residential development by 2040. This is a potential area for expansion in the Carver County transit system.

Waconia is home to Ridgeview Hospital, various pharmacies, chiropractors, and other health services. These services are the closest healthcare infrastructure locations for residents in the rural towns in Carver County, as shown on the Carver County Health Care Providers Map.

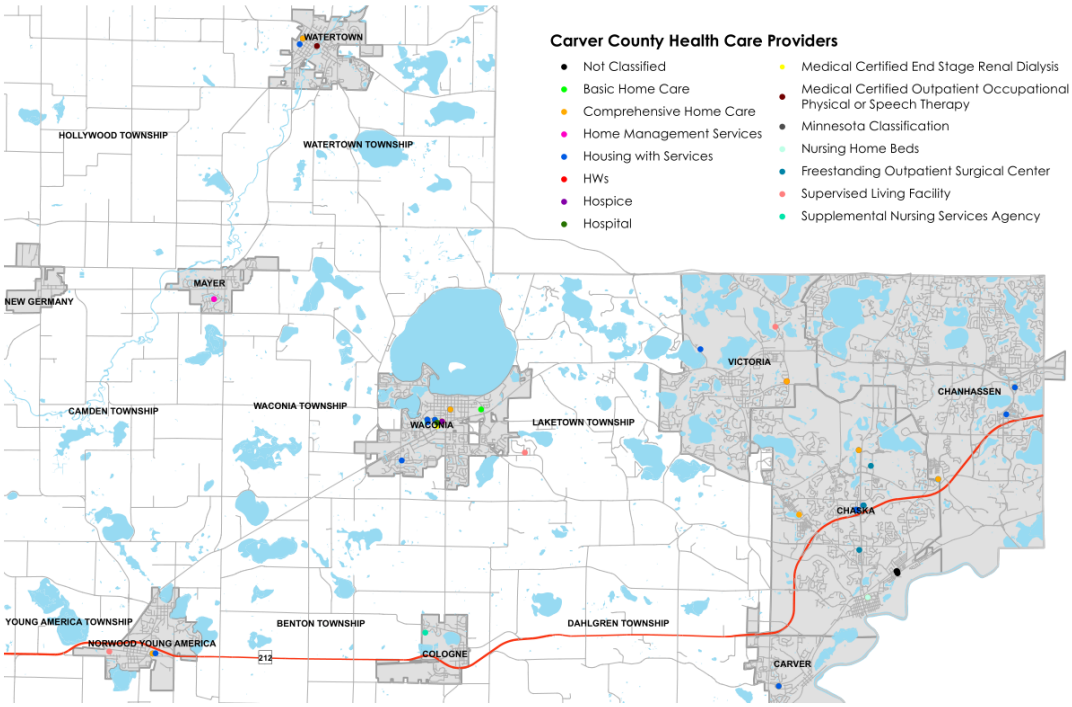

Figure 11: Locations of Carver County Health Care Providers. Provided by Carver County

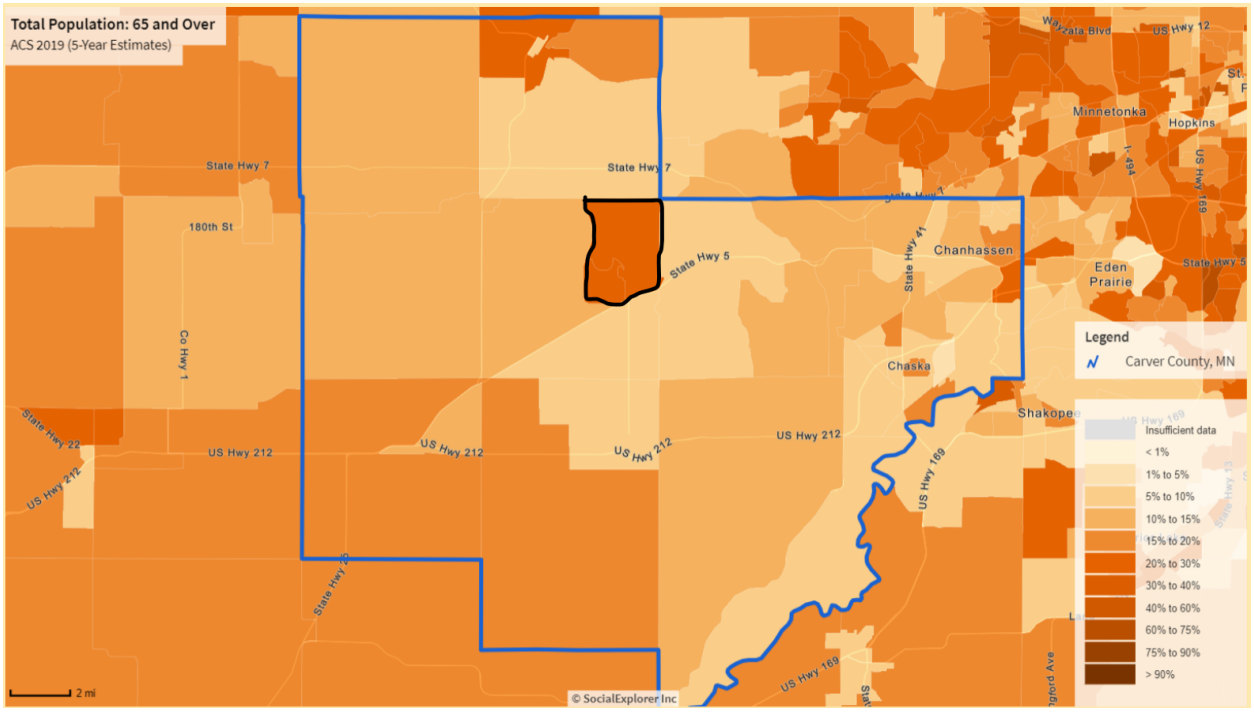

Figure 12: Percent of population 65 and over by Census tract in Carver County. Waconia is outlined in black

As seen above in Figure 12, the Waconia area, outlined in black, has a high concentration of residents over the age of 65. There is a higher concentration of assisted- and independent-living facilities which house a great number of elderly people who are transit reliant. These factors make Waconia an important location for transit. There may be residents in the county's western small towns who require transportation to Waconia for healthcare, or elderly residents within the Waconia community who rely on transit to get around.

Based on Figure 9 and Figure 10, the combined population of Waconia and Waconia township is expected to increase from 11,925 to 22,080 by 2040. A higher concentration of residents in this area may mean a higher concentration of transit-reliant residents or a greater demand for transit services.

TransitLink, the primary transit provider available for residents in small towns to reach Waconia, only runs during the week. If a transit-reliant resident requires a ride on the

weekends, they may have to get a ride from a friend, which may not be an option, or use Lyft or Uber, which is cost prohibitive.

The project team performed an informal price comparison of Uber and Lyft in Carver County. The average Lyft and Uber prices from various small communities on the western side of Carver County to Waconia generally run from $30-$50, over 10 times the price of the average Transit Link ride.

RESULTS

Gap Analysis

The following is a list of the gaps where Carver County can improve their transit system.

Id	Gaps	Why it matters
1	Lack of transit options on the weekends	There is a lack of transit options on the weekends. This is a notable gap because transit-reliant residents will need to find other options to get around then. Other options may be limited by availability or cost.
2	Rapid population growth in Waconia and Victoria will lead to a transit gap	The combined populations of Waconia and Victoria are predicted to increase by around 20,000 in the next 20 years. A big portion of this increase will be suburban development that will house people who work outside of Carver County, presumably downtown. Currently the nearest park-and-ride to Waconia and Victoria is 10-20 minutes away. As the population of Carver County grows and more stoplights are added and more cars are on the road, this time will increase. The park-and-ride in Carver will also be much busier as more people use it. Right now, this is not a gap. As time goes on, Carver County will need to address this issue.
3	Transit System Informational gap	There is no centralized place with information about all of the different transit providers in Carver County. This is not a problem for 'tech-savvy' residents who are able to navigate the internet and find the relevant information. For elderly residents or people who do not have access to the internet this could be a major hindrance to transit use.
4	Metro Mobility does not	Metro Mobility is designed to transport people with

	serve the rural communities	disabilities that would make other types of transportation difficult. Each of TransitLink's vehicles has 2 spots for disabled riders which allows TransitLink to serve a similar role as Metro Mobility. The gap that the project team found was in the scheduling of the two providers. TransitLink denies rides while Metro Mobility does not. The project team considers this to be a gap because if the demand for rides grows enough, transit-reliant residents may be denied rides.
5	Resident transit use knowledge gap	The data available to the project team was all quantitative. The gap in knowledge is why people are using transit. Carver County was aware of this and is planning a survey.

Table 4: Identified Gaps

Recommendations

Having completed the gap analysis, the project team has the following recommendations of ways to improve Carver County's public transit that address the gaps given in *table 4*. The recommendations that we are making are based on the data that we have. If Carver County wants to pursue any of our recommendations, we suggest that they conduct a cost analysis before making any decisions.

Recommendation	Explanation
Expand TransitLink to the weekend	In response to **Gap 1**, The project team suggested that Carver County work to expand TransitLink's hours of operation to the weekend to better serve their transit-reliant residents. Through their survey, the county should gather data on what the need for transit on the weekend is. The supply of rides from TransitLink can initially be determined based on that and then further tweaked based on the demand.
A SouthWest Transit line that originates in Waconia and stops in Victoria en route to downtown	In response to **Gap 2**, the project team recommended that the county work with SouthWest Transit to perform an analysis of creating a park-and-ride station in Waconia and Victoria by 2040. A new fixed route through Waconia and Victoria would preemptively address the future need for commuting options.
Create a centralized source of information for transit providers in	In Response to **Gap 3**, Carver County should create a list that describes all of the transit providers in the county, who qualifies to use them, what they cost, and when they operate. This will help those who are new to Carver

Carver County.	County, those who are not very tech savvy, and those who would benefit by using one of the smaller providers. The list should be found both online and in places where transit-reliant residents are likely to find it such as a brochure at a doctor's office or to be requested by mail.
Extend Metro Mobility's service area beyond the suburbs to the rural towns or increase the number of vehicles that TransitLink has	In response to **Gap 4**, the project team recommended that Carver County either extend Metro Mobility's service to the rural areas, increase the number of vehicles that TransitLink has, or have TransitLink change their policy on denying rides to delaying rides instead. This recommendation was to ensure that transit-reliant residents are not being denied rides and forced to find a ride elsewhere.
Expand the survey	Carver County shared their planned transit survey with us. There are a couple of questions that should be added to gauge whether the recommendations we are making would be beneficial. 1. If the person uses TransitLink, ask whether they would use it if it operated on the weekend. 2. If the person bikes for transit, ask whether they consider the bike trails and paths safe and well connected. 3. If someone has stopped using public transit, ask them why that is the case.

Table 5: Recommendations and Explanations

LESSONS LEARNED

One lesson we learned is that real-world data is rarely going to perfectly address your needs. Unless you are collecting that data yourself, it will never be exactly what you want. We also found that as we progressed through collecting the data, we became aware of more data that we should use in our analysis. For future students, we recommend that, if possible, you allow some time in your schedule for collecting data that you didn't know about.

Another lesson learned was that communication within the team is critical to the success of the project and ensuring that the workload is split evenly. In preparation for working on deliverables, we would split the work as evenly as best we could predict. As we worked on our individual parts, the actual workloads would diverge from what we had predicted. Additionally, some group members would put off their work without communicating their intentions. Overall, this led to frustration within the group as some members felt they were doing more than their fair share of the work. After discussing this as a group, we decided to increase our

communication as a team so that we could adjust the duties of each team member as the deliverable was being completed. For future students, we recommend that you communicate often and work together to ensure that everyone is contributing equally. It is better to over communicate than to not communicate enough.

The last thing that the team learned is that engineering for public works is a great way to have a big impact on society. Our engineering skills can be applied to a wide range of problems beyond industry and private sector work. Our recommendation to future students as they look for internships, co-ops, and jobs is that they widen their search to the public sector to see what opportunities there are to use their skills for societal improvement.

PROJECT MANAGEMENT

Technical Progress

The team has made significant progress on the project. As of April 23rd, the project was 87% completed in total, with project deliverables at 85% completed and product deliverables at 91% completed. A chart showing the overall progress of the project is shown below in Figure 13.

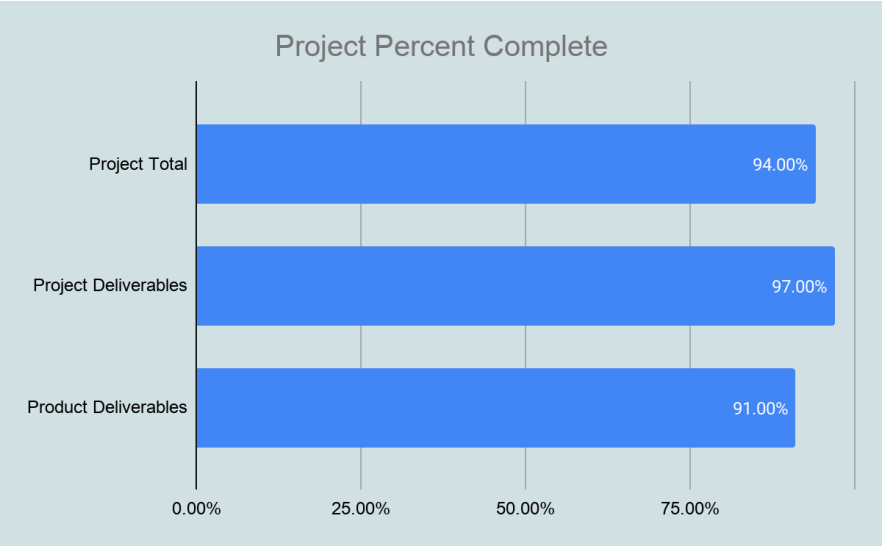

Figure 13: Chart showing overall project progress.

The product deliverables of this project were divided into four separate phases for easier progress tracking. The first two phases involved data collection and analysis, while the last two involved application of the data in the team's transit recommendations. A chart depicting the percent completion of the product deliverable phases is shown below in Figure 14.

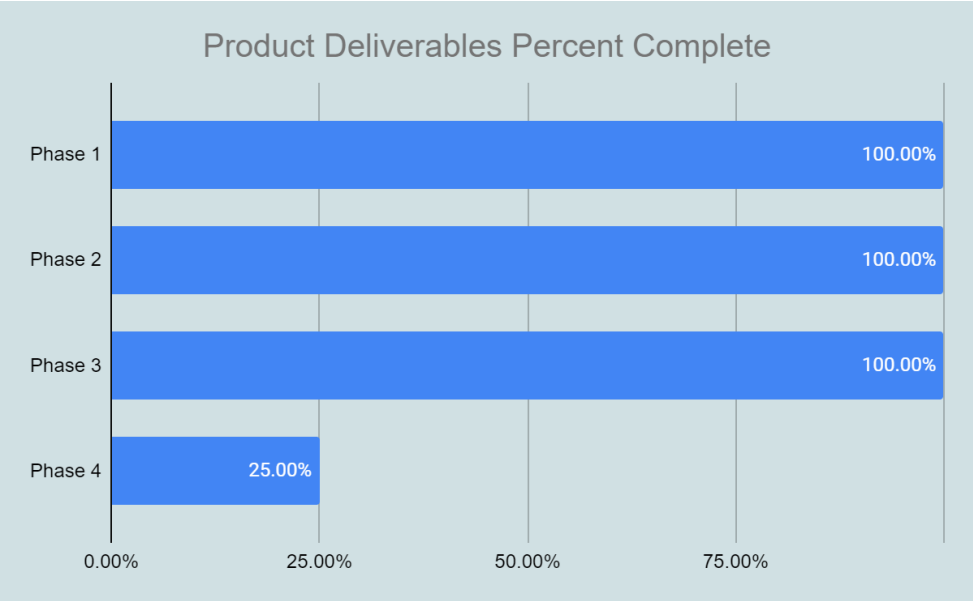

Figure 14: Chart showing the progress of product deliverable phases.

Over the course of the project, there were very few significant delays. Delays were primarily caused by communication errors with the Carver County RCP team regarding the creation of certain maps and data visualizations. All of these delays were resolved quickly. The final phase of product deliverables is expected to finish on schedule. A truncated version of the project schedule is shown in Appendix X.

Issue and Change Log

Throughout the project, the team encountered some minor issues with technical progress. To work through these unforeseen circumstances some changes were made during the project. An updated Issue and Change Log is located in Appendix D.

Risk Register

The team was able to identify and close out 6 risks throughout the course of the project. An updated risk register is located in Appendix E.

CONCLUSION

The project team was able to successfully analyze the data provided in order to understand the current state of Carver County's transit system and identify growth opportunities for the future. From the ridership and population data, the team's recommendations utilize the transit framework already in place in the county but also provide insight on where extensions or changes could be made in the next twenty years to ensure the transit needs of the residents of Carver County are met through the year 2040.

The insights and recommendations from this project are data-focused, but may be more strongly backed by the county's upcoming survey regarding transit behavior and use. The recommendations from this project include both large, potential infrastructure changes and softer informational material program recommendations.

APPENDICES

Appendix A: RACI Matrix

In the RACI Matrix below, the roles of stakeholders are as follows:
R: Responsible for, A: Accountable, C: Consult with, I: Inform as needed

Project Deliverables	Jacob	Katherine	Spencer	Zach	Adriana	Sarah	Prof. Benjaafar	Prof. Miller & Prof. Wong
SOW	**R**	**R**	**R**	**R**	**A**	**C**	**I**	**I**
Project Plan	**R**	**R**	**R**	**R**	**A**	**C**	**I**	**I**
Technical Report	**R**	**R**	**R**	**R**	**A**	**C**	**I**	**I**
Final Report	**R**	**R**	**R**	**R**	**A**	**C**	**I**	**I**
Presentation	**R**	**R**	**R**	**R**	**A**	**C**	**I**	**I**
Product Deliverables								
Data Sourcing	**R**	**R**	**R**	**R**	**R**	**I**	**I**	**I**
Data Aggregation and Analysis	**R**	**R**	**R**	**R**	**A**	**I**	**C**	**I**
Gap Analysis Report	**R**	**R**	**R**	**R**	**A**	**C**	**C**	**I**
Methodologies Report	**R**	**R**	**R**	**R**	**A**	**C**	**C**	**I**

Appendix B: Population, Household, and Employment Projections

City or Township	Population				Households				Employment			
	2010	2020	2030	2040	2010	2020	2030	2040	2010	2020	2030	2040
Benton Township	786	740	720	710	297	300	300	300	274	300	320	330
Camden Township	922	900	860	840	329	340	340	340	56	70	80	80
Carver	3,724	6,300	10,300	15,500	1,182	2,120	3,630	5,600	187	650	1,030	1,700
Chanhassen	22,952	26,700	31,700	37,100	8,352	10,000	11,900	14,000	9746	12,920	14,630	16,300
Chaska	23,770	27,100	32,000	36,600	8,816	10,400	12,300	14,200	11,123	13,600	16,000	17,600
Cologne	1,519	2,100	2,940	3,910	539	800	1,170	1,600	270	370	420	470
Dahlgren Township	1,331	1,140	870	710	494	460	360	300	202	410	460	500
Hamburg	513	510	550	600	201	210	230	250	109	130	140	150
Hancock Township	345	360	390	410	127	140	160	170	10	10	10	10
Hollywood Township	1,041	1,030	1,130	1,170	387	410	470	500	90	150	170	180
Laketown Township	2,243	1,430	640	200	660	530	260	60	116	170	80	60
Mayer	1,749	2,070	2,520	2,950	589	750	980	1,200	151	180	190	200

New Germany	372	440	590	700	146	190	270	330	46	70	80	90
Norwood Young America	3,549	4,580	7,200	9,200	1,389	1,900	3,030	3,900	1,165	1,600	1,850	2,100
San Francisco Township	832	870	940	990	307	340	370	400	46	70	90	100
Victoria	7,345	10,000	12,600	15,400	2,435	3,500	4,570	5,700	1,502	2,100	2,380	2,600
Waconia	10,697	14,200	20,600	24,000	3,909	5,400	8,000	9,500	5,578	7,600	8,700	10,200
Waconia Township	1,228	1,320	1,430	1,480	434	490	560	600	98	240	330	380
Watertown	4,205	4,900	6,200	7,200	1,564	1,900	2,500	2,900	556	740	830	1,200
Watertown Township	1,204	1,160	1,120	1,100	468	490	500	500	392	410	420	430
Young America Township	715	670	660	670	266	270	280	300	119	120	120	120
Carver County (total)	**91,042**	**108,520**	**135,960**	**161,440**	**32,891**	**40,940**	**52,180**	**62,650**	**31,836**	**41,910**	**48,330**	**54,800**

Appendix C: Truncated Project Schedule

WBS	Task Name	Start	Finish	Duration	Actual Work	Baseline Work	Work	% Complete
1	Carver County Transit Recommendations 2021	Tue 1/19/21	Tue 4/27/21	71 days	303.8 hrs	0 hrs	330.4 hrs	87%
1.1	Project Deliverables	Tue 1/19/21	Wed 1/27/21	7 days	160.8 hrs	0 hrs	165.4 hrs	85%
1.2	Product Deliverables	Tue 1/19/21	Fri 4/16/21	64 days	143 hrs	0 hrs	165 hrs	91%
1.2.1	Phase 1: Acquire and Compile Data	Tue 1/19/21	Thu 2/18/21	23 days	16 hrs	0 hrs	16 hrs	100%
1.2.2	Phase 2: Analyze Transportation Trends	Mon 2/22/21	Wed 3/17/21	18 days	68 hrs	0 hrs	68 hrs	100%
1.2.3	Phase 3: Apply Data Analysis to Initial Recommendations	Thu 3/18/21	Tue 4/6/21	14 days	51 hrs	0 hrs	51 hrs	100%
1.2.4	Phase 4: Present Recommendations to Carver County RCP	Wed 4/7/21	Fri 4/16/21	8 days	8 hrs	0 hrs	30 hrs	25%

Appendix D: Issue and Change Log

Category	Description
Issue	The team did not have all the data necessary originally accessible through BaseCamp, specifically regarding geographic locations of infrastructure
Issue	The team had a miscommunication about Status Updates #5 and #7 causing them to not be turned in
Change	Relating to the previous issue, the team has since discussed the order of the Status Update rotation and has fixed it to be clear to all
Change	The team decided against a full literature review and will simply summarize relevant findings in a table

Appendix E: Risk Register

ID	Risk	Category	Failure Effect	Trigger	Severity (1-5)	Likelihood (1-5)	Detection (1-5)	RPN	Response	Contingency Plan	Status
1	Ridership data for Carver County stops	Product	The ridership data is too general and becomes unusable or less effective	The transit providers are unable to separate the data by county or do not track ridership by county only quantity	4	4	2	32	Accept	The team will have to make inferences from what is available to them or turn their attention to other data and indicators	Closed
2	Team members' GIS experience	Technical	The team is unable to create desired graphics and visuals	Data analysis and early results prompt the need for GIS maps for further inspection	3	5	2	30	Mitigate	The team will outsource GIS work to Adriana at Carver County	Closed
3	Private transportation companies may not share their ridership data	Product	The team cannot access or use data from that provider to inform their recommendations to Carver County	The team requests this data from the providers and/or Carver County and it is not able to be shared	5	1	3	15	Accept	The team will use what data is available to them or look for other general transit data elsewhere	Closed
4	Team member could contract Covid - 19	Project	The team member may be unable to participate in group activities for a period of time, shifting the workload distribution	A team member tests positive and informs the rest of the team.	1	2	3	6	Accept	The team will redistribute the workload and continue work without that team member but will keep that team member informed	Closed

5	GIS software may not run on team members computers	Technical	The team is unable to open, view, or work on any GIS files shared as part of the data sets or data visualizations	Team recognizes data analysis needs that require GIS software	2	2	2	8	Mitigate	The team will reach out to contacts at the University and Carver County for assistance using GIS and creating the necessary maps and visuals	Closed
6	Project may not be completed on time	Project	The full scope of recommendations may not be available for presentation	The project is behind schedule and cannot be crashed	4	2	2	16	Mitigate	The team will compile all recommendations to date and create a comprehensive presentation of current solutions	Open